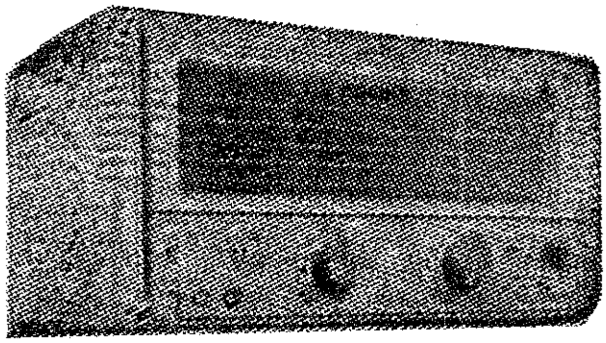
The only one of its kind Gained Excellent Reputation for good Sensitivity & Well-Engineered Construction.



THE EDDYSTONE '750' COMMUNICATION RECEIVER.

BY

J. N. WALKER. (G5JU).

MANUFACTURERS:
Stratton & Co., Ltd.,
Eddystone Works, Alvechurch Road,
West Heath, Birmingham, 31. (England).

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Introduction.

The Eddystone '640' Receiver introduced in 1947, is well known in Arabia and has earned excellent reputation for good sensitivity, low background noise and well-engineered construction. Production of the '640' ceased some time ago and the manufacturers, Messrs. Stratton & Co. Ltd., Birmingham, England, have introduced an improved receiver, the model '750'. The following paragraphs discuss present-day amateur requirements and show how they have been met in the '750' receiver.

Selectivity.

Undoubtedly, with the considerable increased activity on practically all amateur bands in many countries, a most essential requirement is selectivity of a very high order.

As many readers will know, the overall selectivity depends (in a superheterodyne receiver) to a large extent on the design of the IF stages and such design covers many factors, including number of stages, frequency, degree of coupling between coils, and types of valves used.

By suitably designing the coils, a very steep IF response curve can be secured if the frequency is made rather low, that is, in the region of 80 to 110 Kc/s. It is not feasible, however, to employ low frequency IF stages immediately following the frequency changer for the reason the image interference will then be so serious as to be intolerable, particularly on the higher frequencies, where the RF stage, no matter how well designed, will not tune sharply enough to permit adequate rejection of the image signals.

One of the best methods of eliminating image interference is to employ a fairly high intermediate frequency and 1.6 Mc/s is in common use. This is the IF in the '640' Receiver and although, because of their exceptionally good design, the IF stages in the '640' give better-than-average selectivity, a still higher degree is desirable.

The answer to the problem of obtaining high adjacent channel selectivity with freedom from image interference is to adopt the double superhet principle as has been done in the '750' Receiver. The first IF is 1629 Kc/s and the second 85 Kc/s. In the 85 Kc/s transformers, the coupling between the coils can be varied mechanically to give a wide range of selectivity. At the extreme, the response is 60 db down at 5 Kc/s off resonance, giving a very sharp "noie" and almost the highest usable degree of selectivity. This position is for CW reception—telephony is still readable but the side bands are cut to a considerable extent.

With the selectivity control at minimum, the response is 30 db down at 5 Kc/s off resonance. This still represents a much higher the average selectivity and telephone stations only a few kilocycles apart can be separated easily, whilst maintaining moderately good audio quality. As a matter of interest, provided a loudspeaker of adequate size is used, properly mounted, the quality of speech and music from broadcast stations will satisfy all but the most critical.

Problem associated with the Double Superhet.

The construction of a double superhet receiver is not quite such a straightforward job as it might seem. It must be remembered that there are altogether three oscillators operating when CW signals are being received—one variable according to the signal frequency, one at 1535 Kc/s and the BFO at 84/86 Kc/s. Obviously, very careful attention is necessary to avoid interaction between the fundamental and harmonic frequencies and the screening and decoupling must be beyond reproach. The manufacturers do not claim that the '750' is completely free from occasional heterodyne beat—it would involve vast expense to ensure complete immunity—but they do claim that on the two higher frequency ranges spurious signals are to all intents and purposes non-existent and so weak on the other two ranges as to cause no difficulty.

Sensitivity and Signal-to-Noise Ratio.

These two features are being dealt with as one, since it is pointless to quote only sensitivity, without reference to the noise level. By adding valve after valve to a receiver, the absolute sensitivity can be increased but whether any worth while improvement in actual reception of signals takes place depends on how much the noise level increases. Which leads do a point about specifying sensitivity. Most well designed communications receiver will render audible signals having a strength of one microvolt or possibly less, but the information is really useful only when a figure is quoted in comparison with noise. In the '750' the *minimum* sensitivity is quoted as 5 microvolts for a 20 db signal-to-noise ratio - which is an extremely good figure. It simply means that a comparatively weak signal is audible against a very quiet background and this is one of the most noticeable and most appreciated features which immediately claim attention when one comes to use the '750'.

It is normal for the sensitivity to vary to some degree over each range of a receiver. Sometimes, the variation is great but in the '750' the interstage couplings have been adjusted so that the variation is small. Maintenance of accurate tracking of the ganged condenser also assists considerably in this respect.

Valves.

Of recent years much research has taken place in the development of improved valves and the modern miniature types have many advantages over older types. One is the short lead-out wires, resulting in low inductance, another the lowe anode/gris capacity, achieved by reason of better internal screening—two factors which materially assist in improving the high frequency performance. In the '750', nine miniature valves are employed, plus a rectifier and a neon stabiliser, the two latter being of the octal type.

Circuit Line-Up.

By reason of careful design and the use of a high slope 6BA6 valve, the RF stage gives amplification of a high order. The gain is more than sufficient for all normal purposes and the addition of a second stage is not justified.

Then follows the first frequency changer, in which position an ECH42 triode-hexode valve is used. The anode of the triode portion is earthed and the oscillator voltage, developed by a separate valve (a 6AM6) is injected into the grid. An increased degree of frequency stability is thereby secured.

The output at 1620 Kc/s from the IF transformer in the anode circuit of the ECH42 is fed direct to the second frequency changer, another ECH42. Now some may question the absence of an intermediate amplifying stage, so a few words on this will not be out of place. Whether or not an amplifying stage will be of benefit depends on the signal voltage required at the grid of the second frenquency-changer to ensure a high signal-to-noise ratio. In the '750', the high gain given by the RF stage, the good conversion efficiency of the first frequency-changer, and the high "Q" of the voltage magnification given by the 1620 Kc/s IF transformer result in the voltage at the grid of the second frequency changer being adequate without further amplification.

The oscillator section of the second ECH42 operates at a fixed frequency of 1535 Kc/s and the resulting output at 85

Kc/s is fed to a high "Q" transformer and amplified by the 6BA6 high slope valve. As mentioned earlier, the coupling between the windings in both transformers are continuously variable by a mechanical leakage controlled by a butterfly knob on the front panel.

There follows a double diode triode. the diode being employed one for signal detection, the other for AGC, the triode section amplifying the audio signal before it is passed on to the high slope N78 output valve. The latter is a new type of Osram manufacture and is capable of giving in excess of 3.5 watts output at a low level of distortion.

One diode of a type 6AL5 valve is used as a series noise limiter, and, as a result of the careful attention given to the design, this limiter is strikingly effective and is a great boon in situations where automobile ignition and similar interference is prevalent. The noise limiter has only a slight effect on the general audio level.

The second diode is connected in series with the external "S" Meter (when used). By its normal rectifier action, it prevents the flow of current in a reverse direction, and thus prevent possibility of damage to the 200 microampere movement fitted to the "S" Meter.

The BFO is a completely screened unit, utilising a 6BA6 valve and designed for high stability.

The VR150/30 stabiliser valve regulates the HT voltage to the anodes of the oscillator valves, to the screen of the first frequency changer valve and also to the resistor network associated with the "S" Meter when the latter is used. Finally, there is a 5Z4G rectifier valve.

Special Points about the '750'.

Attention has already been drawn to the high selectivity and sensitivity possessed by the '750' receiver and there are a number of other features which deserve mention.

The heater circuits are balanced, the centre tap of the transformer winding being earthed. Heater by-pass condensers are used where necessary and tray couplings through the heater wiring minimised. As a result, there is a complete absence of modulation hum right up to the highest frequency — signals with a T9 note are heard as T9. The smoothing in the HT lines is fully adequate and no hum is heard from this source.

Special attention has been given to the noise limiter circuit, not only to make it fully effective, but also to prevent the introduction of hum due to heater cathode leakage. A separate centre tapped winding is employed for the noise limiter valve and a bias system is arranged to ensure that the cathode is positive to the heater.

The transformer fitted to the '750' is of generous size and is capable of providing more power than the '750' actually uses. The transformer therefore runs cool under any conditions. All components are finished for tropical use, the metal has been specially treated to resist corrosion and reliability of a high order is assured even when the receiver is operated in areas of high ambient temperature and humidity.

Tuning Mechanism.

The train of spring-loaded gears forming the tuning mechanism is a fine piece of small engineering. The control knob spindle is flywheel loaded and the movement is smooth and positive. The mean reduction ratio between control knob and gang condenser spindle is approximately 150 to 1, which makes possible very fine tuning. The scale is directly calibrated, a noticeable feature being the linear spacing of the markings. The dial is large, occupying the major portion of the front panel and it is edge-illuminated by three small lamps fitted along the top.

Band-Spread.

Driven from the main gears is a rotating scale, the gradation on which (0—100 divisions) are read off in the opening at the top of the main scale. For every complete revolution of the auxiliary scale, the main pointer moves the length of one major division printed at the bottom of the main scale. In all, the band-spread scale covers 2,500 divisions over each wave range, equivalent to a length of about 32 feet. It follows that ample band-spread is available on each of the amateur bands, the actual figures being given below. These are based on the allocations made at the Atlantic City Conference.

Band Width.	Tuning Coverage On Vernier Scale.	Vernier Divisions of Band-Spread.	Kilo-cycles in Band.
29.7 Mc/s to 28 Mc/s	34 375"	208	1700
21.45 Mc/s to 21 Mc/s	7.5"	45.5	450
14.35 Mc/s to 14 Mc/s	6.45"	39	350
7.3 Mc/s to 7 Mc/s	15"	91	300
4.0 Mc/s to 3.5 Mc/s	61"	364	500
2.0 Mc/s to 1.8 Mc/s	30"	182	200

Use other than on Amateur Bands.

The total coverage of the '750' Receiver is from 32 Mc/s (below 10 metres) to 480 Kc/s, continuous except for a small gap which must necessarily be allowed on each side of the first intermediate frequency of 1620 Kc/s. It will be appreciated therefore that the '750' is suitable for the reception of short wave broadcast stations on all internationally allocated frequencies, for reception of commercial and ship stations (telegraphy or telephony) and for medium wave reception, in areas where stations operate on medium waves. Provided the loud speaker employed is capable of good reception, excellent quality is obtained from the '750' Receiver with the selectivity switch at "minimum", whilst at the same time, interference from stations on adjacent channels is much reduced, if found at all, because the inherent selectivity of the '750' is considerably greater than the average domestic broadcast receiver.

Absence of Crystal Filter.

The selectivity given by the '750' Receiver with the control at maximum is so great that it is practically impossible to make effective use of any greater degree. It is therefore not necessaıy to go to the expense of adding a crsytal filter, with the attendant complications.

Operation on Telephony.

With its high sensitivity and low noise level, the '750' Receiver is the ideal for those whose interests lie in the reception of weak telephony, either from amateur stations or from far distant broadcast stations. The intelligibility of such transmission can be enhanced by careful adjustment of the selectivity control, which should be at minimum with strong stations and in cases where interference is not present. Unfortunately, under present day conditions, interference is a major problem and occurs only too often. Moving the selectivity control towards maximum will gradually cut it out and only in extreme cases will it be necessary to use the highest possible selectivity.

Automatic gain control in the '750' is most effective and the audio output from a given signal is held within close limits despite severe fading.

CW Operation.

Some experience is necessary with any receiver if maximum results are to be secured and the '750' is no exception to this rule. When the BFO is switched on, AGC is cut out (otherwise the sensitivity would suffer). With minimum selectivity, the IF transformer couplings are optimum and there is rather more IF gain available than is desirable under normal circumstances. Hence IF gain should be reduced manually.

In the majority of cases, it will be advantegeous to use a high degree of selectivity, and, with the transformer couplings below optimum, the IF gain control should be advanced.

The BFO pitch control gives a variation of 3 Kc/s each side of zero beat. Because of the very steep slope of the selectivity curve, it will be found that a signal peaks up, on the side to which the BFO pitch is set. When interference is present, it can often be reduced or removed by moving the BFO pitch to the other side of zero beat and then slightly returning. In effect, single signal reception is possible.

Standby Switch.

The standby switch is fitted with a long "dolly" (operating lever) so that there is no mistaking it from the other switches The method used for muting the receiver is to increase the bias on the IF amplifier valve, with the HT remaining on all stages. Two benefits result - the oscillator valves operate under constant conditions thereby maintaining good frequency stability and the receiver is available to monitor the out going signal from the associated transmitter.

Pick-Up Terminals.

Provision is made for the use of a standard type crystal or magnetic pick-up and, as the audio section of the '750' receiver has a practically linear frequency response from 50 10 10,000 c p.s., the quality of reproduction from gramophone records is excellent.

The pick-up terminals serve another useful purpose— a signal from a separate monitor (CW or telephony) can be fed in and will become audible on the telephone or loudspeaker, thereby rendering unnecessary an external switch.

"S" Meter.

Some operators like to have available an "S" Meter, which instrument can be very useful for comparative reports of telephony transmissions and as a tuning indicator. Other operators, and particularly those whose main interest is CW, do not require an "S" Meter and the latter is therefore made an optional extra. It takes the form of a diecast housing finished to match the receiver and fitted with an octal plug which only has to be inserted in the socket at the rear of the receiver to bring the "S" Meter into use.

Power Requirements.

The '750' Receiver is designed for operation normally from AC mains, 40/60 cycles, a voltage selector panel enabling voltage of 110, 200/220 and 230/250 to be chosen. The consumption from the mains is approximately 70 watts. The transformer is of more than adequate size and runs cool over an extended period. Very generous smoothing is included, with a consequent absence of hum.

On occasions, it may be desired to operate the receiver from a battery supply and a special vibrator unit is available to meet this requirement Listed under Cat. No. 687/1, this unit is contained in a small cabinet which matches the receiver, and is fitted with plugs for connection to the receiver. The consumption from a 6 volt accumulator is in the region of amperes.

Very special attention has been paid to the problem of eliminating the interference-producing "hash" developed by the vibrator itself, provided the instructions supplied with the unit are followed, no difficulty will be experienced from this source.

Construction.

The mechanical construction is most substantial and follows the usual Eddystone standard, with which many readers will probably be acquainted. The front panel is an alluminium diecasting, securely attached to the diecast coil-box. These two units form a solid foundation for the receiver. The very thorough screening conferred by the thick metal coil-box is one reason why Eddystone receivers possess a performance well above average.

The exterior of the receiver is finished a fine ripple black, the steel cabinet first being specially treated to resist corrosion. The workmanship throughout is first-class, and this high standard is maintained equally in all sections. As the illustration shows, the finished product possesses a most presentable appearance.

Conclusion.

Although the foregoing description of the new Eddystone receiver is fairly lengthy, it still does not cover the subject completely nor do justice to the inherent "know-how" which has gone into the design of the receiver. But enough has been said to enable the reader to judge for himself the suitability of the '750' for use in amateur and professional communications and for broadcast reception on high and medium frequencies.

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